 **UNIVERSITY OF MAINE AT FARMINGTON**

**COLLEGE OF EDUCATION, HEALTH AND REHABILITATION**

**LESSON PLAN FORMAT**

**Teacher’s Name:** Kiera Timme **Lesson #**: 3 **Facet:** Interpret

**Grade Level:** Grade 8 **Numbers of Days:** 2

**Topic:** Converting Decimals into Scientific Notation (and vice versa)  
  
**PART I:**  
  
**Objectives**  
Students will understand that scientific notation is used/can be used to represent large and small quantities.  
Student will know place value, powers, scientific notation, standard notation.  
Student will be able to represent large and small quantities using scientific notation.  
  
**Product:** Blog  
  
**Common Core State Standards**  
**Content Area:** Mathematics  
**Grade Level:** Grade 8  
**Domain:** *Expressions and Equations*  
**Cluster:** *Work with radicals and integer exponents.*  
**Standard:** *Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is smaller than the other. For example, estimate the population of the United States as 3 x 10^8 and the population of the world as 7 x 10^9, and determine that the world population is more than 20 times larger.*  
  
**Rationale:**   
In this class, students will be introduced to scientific notation and its uses. Students will explore the processes involved in converting very large, and very small numbers, into scientific notation.  
  
**Assessments**   
  
**Formative (Assessment for Learning)**  
**Section I – checking for understanding during instruction**  
Students will use their math journals to summarize their understanding of scientific notation and its uses. Students will participate in a class discussion, using the "onion ring" activity, to discuss and check that the data they have researched has been correctly converted into scientific notation.  
  
**Section II – timely feedback for products (self, peer, teacher)**  
As the blog posting will include a written explanation of their understanding about scientific notation, student journals will be collected by me and written feedback will be provided. Students will use their graphic organizers and a checklist to help create their blogs. I will review their blogs electronically and then use the same checklist to provide feedback so they can make adjustments.  
  
**Summative (Assessment of Learning):**  
Students will use links, provided by me and posted on the class wiki, to find data about very large and very small objects, animals, buildings, etc.. They will then write a blog posting about what they understand about scientific notation. The blog posting must includes an image and the measurements of the chosen data in scientific and standard notation. All sources must be appropriately cited.  
  
**Integration**  
**Technology:**   
Students will use *blogger.com (or similar)* to create an a blog posting about. This product will also provide students with an opportunity to develop their digital citizenship skills (when using and citing online sources).  
  
**Content Areas:**   
*English/Language Arts* - Students will be writing in reflective journals (on-going). Since they are creating a blog post, student work will have a written component. They will also be required to a works cited list as part of their product.  
*Art (New Media*) - Students will have creative control of the overall aesthetic of their product, which must include images, videos, and audio.  
Science - The majority of the links provided for students to do research on will be scientific in nature. For example endangered animals, harmonics, chemical elements, space, etc....  
  
**Groupings**   
**Section I - Graphic Organizer & Cooperative Learning used during instruction**  
During the lecture/class discussion about scientific notation, each student will be provided with ticktacktoe organizer for note taking. Students will be provided with additional copies of the graphic organizer to complete based on their conversions of very large and very small numbers from the research activity. Students will then be copy down two of their conversions onto a new graphic organizer but must purposely make a mistake on each. Students will split into teams of 3 where they must each "find the fib" in their teammates work.  
  
**Section II – Groups and Roles for Product**  
Students will split into teams of 3 where they must each "find the fib"in their teammates work. Students will work individually while creating their products; however, students will be encouraged to compare their postings with students who have researched a different or similar topic to them.  
  
**Differentiated Instruction**  
**Verbal:** Students will write a blog about their research findings  
**Logic:** Students will think critically to purposely create incorrect scientific notation conversions designed to "out-wit" their classmates  
**Visual:** Students will make use tictacktoe organizer to display their conversions. Research will be conducted through internet site that include images.  
**Musical:** Links to resources on the class wiki will include musical instruments of various sizes to use for data  
**Interpersonal:** Students will work in groups to find their classmates "fibs". This will involve a lot of group discussion  
**Intrapersonal:** Students will be given a choice of links (on the class wiki) to explore based on teacher knowledge of student interests  
**Naturalistic:** Links to resources will include sites with data on animals (large and small), insects, sea life, and plant life  
  
**Modifications/Accommodations**  
***From IEP’s ( Individual Education Plan), 504’s, ELLIDEP (English Language Learning Instructional Delivery Education Plan)*** *I will review student’s IEP, 504 or ELLIDEP and make appropriate modifications and accommodations.*  
  
**Plan for accommodating absent students:**  
The class will have its own Wiki website. All handouts and assignments will be posted on the class wiki. At the end of the class period any SmartBoard presentations will also be uploaded onto the wiki. All students will also be provided with links to Khan Academy that relate to the content being taught to supplement instruction. Anytime a new technology in introduced a student/teacher created screencast or manufacturer tutorial will be posted into the class wiki as a guide on how to use this technology.  
  
**Extensions**  
  
**Type II technology:**  
Students will use *blogger.com (or similar)* to create an a blog posting about their understandings about scientific notation and the data they researched. This product will also provide students with an opportunity to develop their digital citizenship skills (when using and citing online sources).  
  
**Gifted Students:**  
Students will be given options as to the type of resources they use to collect their data. These resources (links) will be grouped in the same way as the problems menus. From this menu, each student will choose two entrees and a choice of two links from the starters and desserts. These link types will be tiered. Links for the entree, starter, and dessert sections will be determined by how challenging it is to extract the necessary data. Starters will be for students who are working towards the standard, and Dessert will be designed to exceed the standard.  
  
**Materials, Resources and Technology**  
*List all the items you need for the lesson.*

* My laptop
* Student Laptop
* SmartBoard (sign up for this)
* Blog set-up instruction sheet/screencast
* Whiteboard
* Whiteboard Markers
* Updated class wiki
* Checklist
* Textbook
* Class wiki with Resources Menu
* Calculator
* Dice
* Conversion Chart (posted to class wiki)

**Source for Lesson Plan and Research**  
  
**Blogger Tour & How To:**  
<https://www.blogger.com/tour_start.g>  
**Khan Academy - Scientific Notation:**  
<https://www.youtube.com/watch?v=i6lfVUp5RW8>  
**HOOK - Song about the virtues of Scientific Notation:**  
<http://www.youtube.com/watch?v=AWof6knvQwE>  
**Units/Measurement Conversion Chart:**  
<http://math.about.com/library/weekly/aa070502a.htm>  
**Class wiki:**  
www.wikispaces.com  
**Citing Sources guide - Owl Purdue Writing Resources:**  
<http://owl.english.purdue.edu/owl/resource/589/01/>  
**Creative Commons website:**  
<http://search.creativecommons.org/>  
  
**PART II:**  
  
**Teaching and Learning Sequence (Describe the teaching and learning process using all of the information from part I of the lesson plan)** *Take all the components and synthesize into a script of what you are doing as the teacher and what the learners are doing throughout the lesson. Need to use all the WHERETO’s. (3-5 pages)*  
  
**Agenda:**  
  
Day One (80 minutes):

* Attendance (3 minutes)
* Hook (5 minutes)
* SmartBoard lecture & Group Discussion about converting decimals into scientific notation (20 minutes)
* Graphic Organizer, Research & Find the Fib (35 minutes)
* Onion Peel (15 minutes)
* Journaling (5 minutes)

Assignment: Complete blogger.com tutorial & set-up account - Get Creative!!  
  
Day Two (80 minutes):

* Attendance & H/W and/or Student directed Q&A (5-10 minutes)
* GAME: "Scientific Notation Toss" (20 minutes)
* Blog (40 minutes)
* Class discussion on any areas that are still unclear (10 minutes)
* [Journaling (0 minutes) - *blog entry will count as that days journal*]

Assignment: Complete blog posting and then upload a link to their site onto the class wiki by given deadline.   
  
*Classroom Arrangement:* Students will be arranged into table groups of four.  
  
Students will understand that scientific notation is used/can be used to represent large and small quantities**.** Did you know that Mathematicians and Scientists were lazy? Well... this is half true. Some numbers are so long and have so many values, that writing the whole thing out just isn't an efficient way to express them. So scientific notation was invented as a way to deal with this problem, and is used in many real world occupations on a daily basis**.** *Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is smaller than the other. For example, estimate the population of the United States as 3 x 10^8 and the population of the world as 7 x 10^9, and determine that the world population is more than 20 times larger.* At the start of the lesson I will have students take out their calculators and type 1000000 x 360000. I will then pause, and ask students what they think this means. After a quick discussion I will play the "scientific notation" [song](http://www.youtube.com/watch?v=AWof6knvQwE) as a fun introduction into our exploration of scientific notation.  
**Where, Why, What, Hook Tailors:** Verbal, Logic, Visual, Musical  
  
Students will know place value, powers of ten, scientific notation, and standard notation (see content notes). We will begin by having a lecture and class discussion during which students will use the ticktacktoe graphic organizer to aid their note taking. Students will then participate in an activity designed to help them understand the steps involved in converting decimals into scientific notation (and vice versa). Students will go to the class wiki to research data they can convert into scientific notation. Once they have found four (4) statistics they must then convert them into scientific notation using their graphic organizers. Students will then copy down two of their conversions onto a new graphic organizer; but, they must purposely make one mistake on each conversion. Students will split into teams of 3 where they must each "find the fib" in their teammates work. In order to check for understanding, students will be given a small piece of paper to write down any questions they may have. These questions will be turned into an "onion ring" and will be reviewed in the form of a class discussion. Students will then reflect on the lesson, and summarizing their understanding, by writing in their journals.  
**Equip, Explore, Rethink, Tailors:** Verbal, Logic, Visual, Interpersonal, Intrapersonal, Musical, Naturalistic  
  
Students will be able to represent large and small quantities using scientific notation. In their teams of three students will play the "scientific notation toss" game as a way to further explore scientific notation conversion. After the game students will begin work on their blog postings. Although students are to work alone, students will be encouraged to compare their postings with students who have researched a different or similar topic to them. Students will use their completed graphic organizers from the previous day to help write a blog posting about what they understand about scientific notation. The blog posting must include an image and the measurements of the chosen data in scientific and standard notation. All sources must be appropriately cited. As the blog posting will include a written explanation of their understanding about scientific notation, student journals will be collected by me and written feedback will be provided.  
**Explore, Experience, Rethink, Revise, Refine, Tailors:** Interpersonal, Intrapersonal, Naturalist, Musical, Verbal, Logical, Visual

Students will use their journal entries, graphic organizers and a checklist to help create and self-assess their blogs. I will review their blogs electronically and then use the same checklist to provide feedback so they can make adjustments before the final grading is completed. In order to indicate that they are ready for the products to be assessed, students will post a link to their blog onto the class wiki. The homework assignments are designed to provide students with an opportunity to better acquaint them with the technology we will be using, and to give students additional opportunities to adjust their final products once they have received teacher feedback. This lesson provides students with a foundation from which they can build, familiarizing them with this new notation before we begin performing operations in the next lesson. It also provides students with an opportunity to develop their research and conversion skills which they will need to complete their performance task.  
**Evaluate, Tailors:** Verbal, Visual, Interpersonal, Intrapersonal, Logical

**Content Notes**   
Students will know…..   
*Definitions:*

* Place value
* Powers of 10
* Scientific Notation
* Standard Notation

**Decimals**

A decimal is a way of writing a number that is not whole. Decimal numbers are 'in-between' numbers.

**For example**: 5.25 is **in between** the numbers 5 and 6. It is **more** than 5, but **less** than 6.

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**Note**: Decimals can be converted to and from percentages and to and from fractions ☺

**For example**: ¼ (a quarter) of a dollar is the same as 0.25 cents

**Place Value and Decimals**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Hundred Billions | Ten Billions | Billions |  | Hundred Millions | Ten Millions |  |  | Hundred Thousands | Ten Thousands | Thousands |  | Hundreds | Tens | Ones/Units |  | Tenths | Hundredths | Thousandths | Ten Thousandths | Hundred Thousands |
| **2** | **1** | **0** | **,** | **9** | **8** | **7** | **,** | **6** | **5** | **4** | **,** | **3** | **2** | **1** | **.** | **2** | **3** | **4** | **5** | **6** |

This chart shows the place value of the number 210,987,654,321.23456.



This is how you say it :

“Two hundred ten billion, nine hundred eighty seven million, six hundred fifty four thousand, three hundred twenty one, and twenty three thousand four hundred fifty six hundred thousandths”

**Powers of 10**

A **power of 10** is any of the integer powers of the number ten; in other words, ten multiplied by itself a certain number of times

**Powers of 10 Chart**

|  |  |
| --- | --- |
| Billions 109 = 1,000,000,000 10 x 10 x 10 x 10 x 10 x 10 x 10 x 10 x 10 = 1,000,000,000  Millions 106= 1,000,000 10 x 10 x 10 x 10 x 10 x 10 = 1,000,000  Hundred Thousands 105 = 100,000 10 x 10 x 10 x 10 x 10 = 100,000  Ten Thousands 104 = 10,000 10 x 10 x 10 x 10 = 10,000  Thousands 103 = 1,000 10 x 10 x 10 = 1,000  Hundreds 102 = 100 10 x 10 = 100  Tens 101 = 10 ones 100 = 1 | Tenths 10-1 = 1/10 1/10 = 0.1  Hundredths 10-2 = 1/102 1/102 = 0.01  Thousandths 10-3 = 1/103 1/103 = 0.001  Ten Thousandths 10-4 = 1/104 1/104 = 0.0001  Hundred Thousandths 10-5 = 1/105 1/105 = 0.00001  Millionths 10-6 = 1/106 1/106 = 0.000001  Billionths 10-9 = 1/109 1/109 = 0.000000001 |

**Scientific Notation**

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* Do you know this number, 300,000,000 m/sec.?

It's the Speed of light !

* Do you recognize this number, 0.000 000 000 753 kg. ?

This is the mass of a dust particle!

Scientists have developed a shorter method to express very large numbers. This method is called**scientific notation**. Scientific Notation is based on powers of the base number 10.

The number 127,000,000,000 in scientific notation is written as:

*The first number 1.27 is called the coefficient*. It must be greater than or equal to 1 and less than 10.

*The second number is called the base* . It must always be 10 in scientific notation. The base number 10 is always written in exponent form. In the number 1.27 x 1011 the number 11 is referred to as the exponent or power of ten.

So the number is written in **two parts**:

* Just the **digits** (with the decimal point placed after the first digit), followed by
* **× 10 to a power** that puts the decimal point where it should be (i.e. it shows how many places to move the decimal point).

**For example**:

Write 5326.6 in scientific notation

5326.6 is written as **5.3266 × 103**,

…because…

5326.6 = 5.3266 × 1000 = 5.3266 × 103

*Check Point*

After putting the number in Scientific Notation, make sure that:

* The "digits" part is between 1 and 10 (it can be 1, but never 10)
* The "power" part shows exactly how many places to move the decimal point

For more examples go to: <https://www.purplemath.com/modules/exponent3.htm>

*GAME: "Scientific Notation Toss"* (*SEE APPENDIX A*)  
  
**Handouts**  
*Step-by-step graphic organizers*  
*Checklist*  
*GAME: "Scientific Notation Toss"*  
  
**Maine Common Core Teaching Standards for Initial Teacher Certification and Rationale**  
  
***Standard 1 – Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.***  
  
  
***Learning Styles***  
  
***Clipboard:*** This lesson is structured to incorporate sequential learning with clear procedures on how to master the content. Lesson expectations are clearly outlined both during the lesson and on the class wiki.  
  
***Microscope:*** This lesson allows for student self-discovery of the content. Students are encouraged to discuss the content with their peers, and to develop a sense of ownership of the material. This is facilitated during the group discussion of the learning, and when students research data and share their solutions with their peers and the school community.  
  
***Puppy:*** At all times every effort will be made to ensure a positive and encouraging learning environment. During group discussion, students will be encouraged (and required) to actively listen to their peer comments. During the product presentation, students will also be instructed on how to provide positively worded feedback.  
  
***Beach Ball:*** The resource selections menu provides students with a choice in the data they put into their product. Students will also partake in a content themed game, providing students with an additional and varied learning opportunity. The class wiki will also contain links to other resources for students to study this material.  
  
***Rationale:*** This lesson is designed to review and reinforce the material discussed in prior lessons (specifically properties of exponents), while also introducing new material in an engaging and meaningful way for all learning styles.

***Standard 6 -* *Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their on growth, to monitor learner progress, and to guide the teacher's and learner's decision making.***  
  
***Formative:***  
Students will use their math journals to summarize their understanding of scientific notation and its uses. Students will participate in a class discussion, using the "onion ring" activity, to discuss and check that the data they have researched has been correctly converted into scientific notation. As the blog posting will include a written explanation of their understanding about scientific notation, student journals will be collected by me and written feedback will be provided. Students will use their graphic organizers and a checklist to help create their blogs. I will review their blogs electronically and then use the same checklist to provide feedback so they can make adjustments.  
  
***Summative:***  
Students will use links, provided by me and posted on the class wiki, to find data about very large and very small objects, animals, buildings, etc.. They will then write a blog posting about what they understand about scientific notation. The blog posting must include an image and the measurements of the chosen data in scientific and standard notation. All sources must be appropriately cited.  
  
***Rationale:*** A variety of assessment forms are used throughout this lesson which provide both the teacher with to check for student understanding, and to allow students to assess their own understanding.  
  
***Standard 7* - *Planning Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.***  
  
***Content Knowledge:*** Students will know how to convert decimal values into scientific notation (and vice versa).  
  
**Common Core State Standards**  
**Content Area:** Mathematics  
**Grade Level:** Grade 8  
**Domain:** *Expressions and Equations*  
**Cluster:** *Work with radicals and integer exponents.*  
**Standard:** *Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is smaller than the other. For example, estimate the population of the United States as 3 x 10^8 and the population of the world as 7 x 10^9, and determine that the world population is more than 20 times larger.*  
  
***Facet:*** Interpret  
  
***Rationale:*** Students will be able to represent large and small quantities using scientific notation.

***Standard 8 -* *Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.***  
  
***MI Strategies:***  
**Verbal:** Students will write a blog about their research findings  
**Logic:** Students will think critically to purposely create incorrect scientific notation conversions designed to "out-wit" their classmates  
**Visual:** Students will make use tictacktoe organizer to display their conversions. Research will be conducted through internet site that include images.  
**Musical:** Links to resources on the class wiki will include musical instruments of various sizes to use for data  
**Interpersonal:** Students will work in groups to find their classmates "fibs". This will involve a lot of group discussion  
**Intrapersonal:** Students will be given a choice of links (on the class wiki) to explore based on teacher knowledge of student interests  
**Naturalistic:** Links to resources will include sites with data on animals (large and small), insects, sea life, and plant life  
  
***Type II Technology:*** Working individually, students will use *blogger.com (or similar)* to create an a blog posting about scientific notation, and the data they researched and converted into scientific notation.  
  
  
***Rationale:***   
This lesson is designed to meet the needs of six out of the eight multiple intelligences in a meaningful and engaging way. Journaling and the blog product, with their reflective components, meet the needs of both verbal and intrapersonal intelligences. The use of graphic organizers and creative smartboard use provides visual learners with a means to engage with the content. Group work provides interpersonal learners with the opportunity to engage with their peers. The links/ research resources posted on the class wiki provide an informative and fun way for musical and naturalist students to explore scientific notation through their interests. The logical structure and sequence incorporated throughout the exploration of the content appeals to logical students.  
  
  
***NETS STANDARDS FOR TEACHERS***  
**1. Facilitates and Inspire Student Learning and Creativity. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.**  
a. Promote, support, and model creative and innovative thinking and inventiveness  
  
b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources  
  
c. Promote student reflection using collaborative tools to reveal and clarify students’ conceptual understanding and thinking, planning, and creative processes  
  
d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments  
  
***Rationale:*** In this lesson students are assigned the task of creating a blog based product. In doing so, students are not only using technology as part of their research, they are also demonstrating their learning, while simultaneously sharing their knowledge through a virtual environment (blogger.com).  
  
**2. Design and Develop Digital Age Learning Experiences and Assessments. Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop knowledge, skills, and attitudes identified in the NETS-S.**  
a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity  
  
b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress  
  
c. Customize and personalize learning activities to address students’ diverse learning styles, working strategies, and abilities using digital tools and resources  
  
d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching  
  
***Rationale:*** Through the use of blogger.com, students are provided with the opportunity to explore and utilize a type II technology as a means to demonstrate their learning in a valid and creative way.